Experiment Manual

TK2 scope

Thames & Kosmos®

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What's Included in Your Microscope Kit

1 Microscope, with ocular lens (Caution! The ocular lens sits loosely. Heed the tip on page 5)

2 Plastic box with:

- Permanent prepared slide of sodium chloride crystals
- Permanent prepared slide of pollen grains
- Permanent prepared slide of paramecia
- Permanent prepared slide of oral mucous membrane cells
- Special slide with concave trough

3 Plastic box with 5 slides

4 Plastic box with cover slips

5 Pipette

6 Tweezers

7 Dissecting needle

8 Scalpel (Caution! Follow the safety tips on pages 3 and 10)

9 Petri dish with cover

10 Blue stain (Brilliant Blue FCF)

11 Red stain (Ponceau 4R)

12 Adhesive labels for your own prepared slides

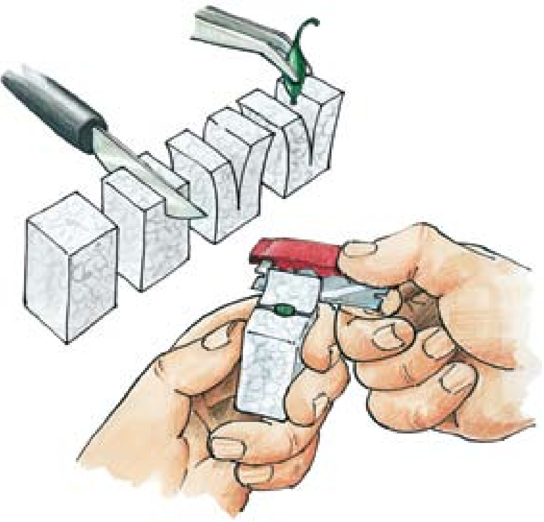
13 Lens cleaning paper

14 Dust cover for the microscope (not shown)

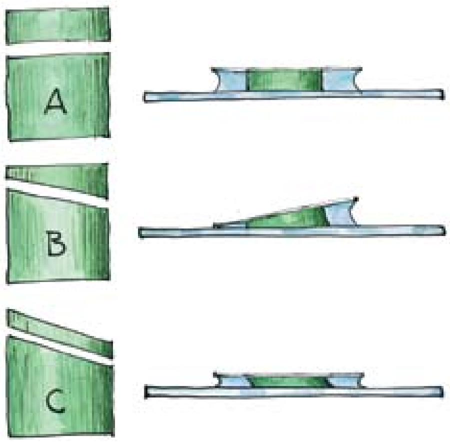
15 Experiment book (not shown)

Also required: Three 1.5 volt AA batteries

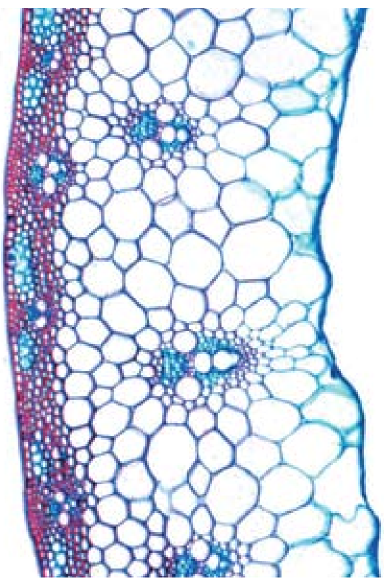
In the event of missing or defective parts, please contact technical support by phone at 1-800-587-2872 or by e-mail at support@thamesandkosmos.com.



Here's how to cut thin sections of leaves and stems using styrofoam.



Although object A in the figure is cut nice and straight, it is much too thick to be able to see anything. Here's the rule of thumb: If the cover slip is lifted off of the slide, then the cut is too thick. Make a thin cut and still can't see anything? That may be because you cut the object on a slant. The object in example B is cut slanted. This can be a very useful method for some objects, especially very hard, lignified branches or pieces of stem. On one side, the object is definitely too thick. But on the other side, lots of things may be visible. Finally, example C is the result when the object is crooked in the styrofoam. In this case, even if thin sections are made, there will generally not be much to see.



Section from the wall of a grass blade. The air-filled pith cavity is visible on the right side.

But a blade of grass is not the same thing as tree trunk. It has to achieve as much stability as possible with minimal material. Let's have a look at a blade of grass under the microscope.

Cutting, Part 2 — The Styrofoam Trick

Producing a good microscopic preparation is truly an art in and of itself and requires some practice. So here are some more tips and notes on common errors. Many objects are too thick to look at in their entirety under the microscope. At the same time, however, they are usually thin enough to yield to the razor blade when cut. So here's a tip:

Take a styrofoam cube (or a piece of carrot) and cut a slit into it from the top. Then stick your object into it (a piece of a blade of grass, a leaf, a root, etc.). When doing this, make sure that the object is straight in the styrofoam. Now you can place the razor blade on the styrofoam (or the carrot) and pull through the styrofoam and object (important: do not simply press the razor blade through the object, since that will crush sensitive parts of the object and make it unsightly). Always make several cuts while you're at it and then place several of them under the cover slip. By doing this, you will simply increase the possibility of getting a good cut.

Hollow Constructions

To study a blade of grass, you will need:

- a slide and a cover slip
- the pipette and water
- the tweezers
- a small piece of styrofoam, or carrot
- a bit of grass blade

Definitely read through the tips on cutting before getting started (see above). Now, make several cuts cross-wise through the blade of grass and place them into a drop of water. Observe the object under the microscope after you have put the cover slip in place. At the lowest magnification (40x), you can first get an overview of the entire cross-section. It is typical with most grasses for the stem to be hollow inside. Around this so-called pith cavity are large cells with thin cell walls. Such cells are often typical storage cells. By virtue of their thin cell walls, they are quite sensitive. Some are sure to have been crushed by the cutting. Located in these large cells are usually small agglomerations of smaller cells: the vascular bundles. Here, you will notice several cells with a large diameter. These are the water ducts that you were able to have a look at with the watermelon (see "How Does Water Get into a Melon?"). This time, however, they are cut cross-wise, so you can't see the ring- or spiral-shaped pattern. You will find other cross-cut vascular ducts among the smaller cells as well. These do not transport water from the root to the rest of the plant, but rather nutrients that are formed with the aid of the sun (see "Living in a Shoebox"). The other cells in the vascular bundle have the task of stabilizing the ducts and providing them with goods to transport. Finally, on the very outside, you will find cells that are responsible for the unbelievable strength of the grass blade. Directly under the outermost layer of cells — the epidermis — there are small groups or even a closed ring of small cells with thick cell walls. Just like in the water ducts, these are mostly dead cells whose sole purpose here is to stabilize the long blade. So if you take another look at the cross-section as a whole, you will notice that the blade achieves maximum stability with little effort and while saving as much material as possible. It's any engineer's dream! It can prove interesting to stain this particular specimen with a blue stain (see page 16). Look at the specimen under the microscope — you will notice that the various types of cells have absorbed the color to varying degrees.

Anchorage in the Ground

Even the greatest of bending strength won't do the blade of grass any good if its anchorage in the ground doesn't hold. Whether the base of a tower or the roots of a plant, extreme reliability is a must. It's apparently most favorable to change the construction principle in comparison to the stem, since the stabilization tissue of a root, which also serves as a vascular duct, is not wrapped around the rest of the root as a sheath, but rather as a central strand in the middle of the root — like a steel cable with a sheath!

A Root in Cross-Section

You will need:

- bean seeds (e.g. broad beans or scarlet runners)
- an empty margarine tub or the like
- cotton wool or paper towels
- a slide and a cover slip
- the pipette and water
- a razor blade (see page 11)
- the tweezers

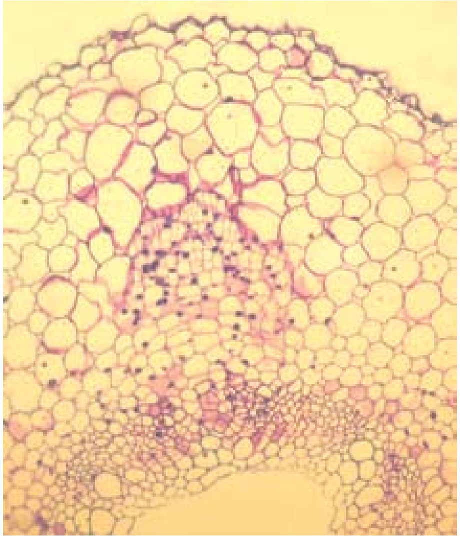
Place a layer of cotton wool (paper towels work fine if none is available) into the empty margarine tub or another plant container and wet it well with water. Lay a few bean seeds on top with some spacing. Then place the tub in a windowsill. You should make sure that the cotton is always sufficiently wet, but the beans should not be swimming in water. After a few days, a few of the beans will begin to germinate. Give the young plants another two or three days' time to develop and then take the roots of the several-days-old seedlings to study.

Cut the root down the middle using the razor blade. Use the thicker upper portion of the root to make thin sections for the microscope. Since the young root is still very soft, it may be quite difficult to place into your cutting aid (see page 38). In that case, you can also simply use the "cutting board method." To do this, place the piece of root onto a slide, hold it in place using the tweezers, and cut as thin pieces as possible from the root — just like cutting a cucumber. Add a drop of water to the cuttings, and the root cross-section is ready. In cross-section, you see a thick layer made of large, thin-walled cells on the outside of the root. In the center of the root, you will find the other types of cells composing the vascular tissue.

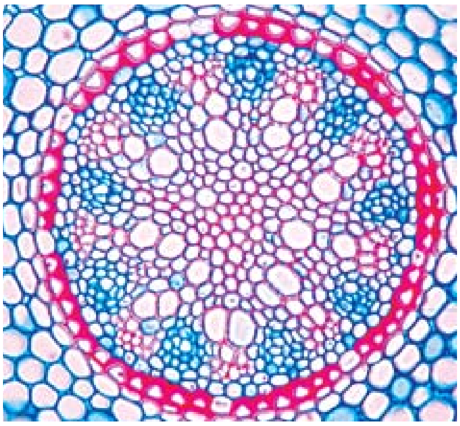
Crazy Surfaces

How does a surface have to look so that as little fine dust and other contaminants stick to it as little as possible? If you think about highly polished car bodies shining and glistening in the sun, you'd probably say that the surfaces would have to be especially smooth. Not so! Surely you've seen how cars are dustier after a downpour than they were before — and without moving an inch. This is because the rain washes the fine dust out of the air and leaves it behind on the cars. Whereas the rain water flows off of the car, the dirt sticks. It's no coincidence that car washes are equipped with all sorts of brushes.

Just imagine the surprise of the people who discovered of the now-famous "lotus effect" when they found that the self-cleaning leaves of the lotus plant have an extremely rough surface. Like the leaves of almost all plants, the rough surface is covered with a layer of wax. So water drops are not able to wet the surface of a leaf any more than your skin right after you've rubbed sun-tanning oil onto it. As they roll down the leaf, the water drops take the dirt that has collected on the leaf along with them.

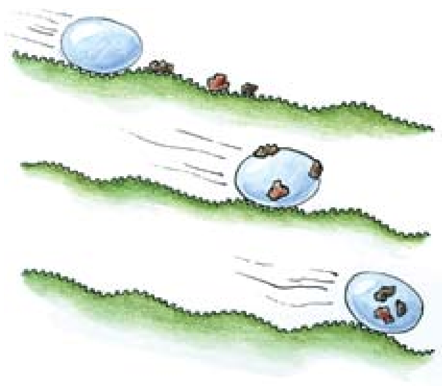


Cross-section through a bean root



Cross-section through a sunflower

The lotus flower, which originated in Asia, looks similar to a water lily.



On the surface of the lotus plant, water drops bead and roll off, taking all of the particles of dust and dirt with them (the lotus effect). This is similar to a water lily.